

**KRANTIGURU SHYAMJI KRISHNA VERMA  
KACHCHH UNIVERSITY, BHUJ**

**Academic Year: 2023-2024**



**Syllabus (NEP – 2020)  
B.Sc. (Honours) MARINE SCIENCE  
(with Research /without Research)**

**Semesters: I and II  
(with Multiple exit-entry options)**

**FACULTY OF SCIENCE**

**A Curriculum of Marine Science  
Faculty of Science framed as per UGC Guidelines and norms of  
National Education Policy (NEP) – 2020.**

**With effect from June–2023**

# **B.Sc.(Honours)Marine Science Programme**

**(WithResearch/withoutResearch)**

**As per NEP-2020**

**WitheffectfromJune-2023**

**FACULTYOFSCIENCE**

**Subject:Marine Science**

**B.Sc.Semesters:I&II**

## AIM OF THE COURSE:

Aims of the B.Sc. (Honours) Course in Marine Science:

- Foster a hands-on learning approach that encourages students to explore and discover the wonders of marine science.
- Embrace modern educational trends like e-learning, flipped classrooms, and hybrid learning to create an engaging and interactive learning environment.
- Cultivate environmentally responsible citizens who play a pivotal role in shaping the future of marine science subject and contribute their knowledge to sustainable development.
- Provide comprehensive theoretical and practical knowledge in Marine Science, equipping graduates with the necessary skills for further studies or exciting careers in marine-related fields.
- Prepare students for national and international competitive examinations, empowering them to pursue advanced research opportunities or secure prestigious positions in marine science and related fields.

## COURSE INTRODUCTION

The new curriculum of B.Sc. in Science (Marine Science) offers the essential knowledge and technical skills to study marine science in a holistic manner. Students would be trained in all areas of marine science using a unique combination of Major, Minor, MDC, AEC, SEC and VAC papers with significant inter-disciplinary components. Students would be exposed to cutting-edge technologies that are currently being used in the study of marine life forms, their evolution, and interactions with other organisms within the ecosystem. Students would also become aware of the social and environmental significance of marine life and its relevance to the national economy. B.Sc. Marine Science Programme covers academic activities within the classroom sessions along with practical concepts at laboratory sessions. Infield, outstation activities, and projects would also be organized for real-life experience and learning. Candidates who have curiosity in the field of Marine, Nature, Ecosystems and eager to exploring various exotic places, and wish to work as researchers or professionals like Marine Scientists, conservationists, Ecologists, etc. can choose the B.Sc. Marine Science course.

## Programme outcomes (POs)

This curriculum in B.Sc. Marine Science aims to cultivate well-rounded individuals who are not only equipped with knowledge in the field of marine science but are also driven to contribute to their nation's progress and shape the future. By studying marine science, students will develop a deep understanding of the oceanic world and its potential for transformative impact on various sectors.

### **Programme specific objectives (PSOs): B.Sc. I Year Certificate Course in Basic Marine Science**

- Dive into the fascinating realm of marine science through this certificate course that covers a wide range of topics.
- Prepare yourself for cutting-edge research in frontier areas of marine sciences by gaining a solid foundation in the subject.
- Explore the diverse habitats, morphologies, anatomies, and reproductive processes of various marine organisms.
- Develop the skills of competent marine biologists who can apply their knowledge to address critical issues in aquaculture, Fishery industry, Marine Pharmacology, and Marine environment sustainability.
- Unlock your potential for self-entrepreneurship and self-employability through the certificate and diploma courses, which offer multiple exit options.
- Embrace lifelong learning by delving into the vast wealth of knowledge surrounding marine science and related subjects.
- Enhance critical thinking abilities, foster a scientific attitude, hone problem-solving skills, and promote effective communication and social interaction in the field of Marine Science.
- Cultivate an awareness of the ethical considerations in the responsible and sustainable use of marine resources.

➤ Equip students with the necessary training to pursue careers in government and private sectors, including academia, research, and industry. Additionally, prepare them for national and international competitive examinations such as UGC-CSIR NET, UPSC Civil Services Examination, IFS, NSC, FCI, BSI, FRI, and encourage self-employment opportunities.

## EVALUATION METHODS:

Evaluation Methods for Marine Science: To assess the achievement of students in the Marine Science subject and ensure their desired learning outcomes, a variety of assessment methods will be adopted. These methods will provide a comprehensive evaluation of the student's academic performance. Here are the innovative assessment methods for Marine Science:

1. **Engaging Examinations:** Both oral and written examinations, including scheduled and surprise tests, will be conducted. These exams will test students' theoretical knowledge, critical thinking, and problem-solving skills related to marine science concepts.
2. **Diverse Testing Approaches:** Closed-book and open-book tests will be administered to assess students' understanding and application of marine science principles. These tests will challenge their ability to think critically and apply concepts to real-world scenarios.
3. **Practical Assignments and Reports:** Students will be assigned practical assignments and laboratory reports to evaluate their hands-on skills and understanding of marine science experiments and techniques. These assignments will provide insight into their ability to collect, analyze, and interpret data in the context of marine environments.
4. **Observation of Practical Skills:** Practical skills, such as field sampling techniques or data collection methods, will be directly observed and evaluated. This assessment method allows instructors to assess students' competency in executing practical tasks related to marine science.
5. **Collaborative Projects:** Both individual and group project reports will be assigned to encourage collaborative learning and foster teamwork. These projects will assess

students' ability to conduct research, analyze data, and present findings on various marine science topics.

6. **Innovative Seminar Presentations:** Students will deliver seminar presentations on specific marine science subjects. This method will not only test their understanding and communication skills but also encourage them to explore cutting-edge research and advancements in the field.

7. **Viva Voce Interviews:** Viva voce interviews will be conducted to assess students' comprehensive understanding of marine science concepts and their ability to articulate their knowledge effectively. This interactive assessment method will provide insights into their depth of understanding and critical thinking skills.

8. **Computerized Adaptive Testing:** Utilizing computerized adaptive testing methods will enable personalized assessment and help identify individual learning needs. These tests can adapt the difficulty level based on the student's responses, ensuring a tailored evaluation.

9. **Literature Surveys and Evaluations:** Students will be required to conduct literature surveys and evaluations on marine science topics. This assessment approach will develop their research skills, and ability to critically analyze scientific literature, and synthesize information from various sources.

10. **Comprehensive Continuous Assessment (CCA):** Students will undergo continuous assessment throughout the course, including internal evaluations. The weightage of CCA will be 30% of the overall evaluation, ensuring a holistic evaluation of their progress.

11. **End of Semester Examination:** The semester-end examination, comprising 70% of the evaluation, will assess students based on their knowledge, understanding, skills,



application, and higher-order thinking skills related to marine science concepts. The assessment will be conducted by the university.

Additionally, to enhance their learning experience, students will be required to participate in at least one Marine Science Excursion, where they will study marine ecosystems and biodiversity in their natural state. Laboratory work must be recorded in certified journals, which will be presented during practical examinations to showcase the students' hands-on expertise.

These innovative and varied assessment methods will enable a comprehensive evaluation of student's knowledge, skills, and understanding of Marine Science, fostering their growth and development in this field.

## Paper and Credit Scheme for Marine Science

Year	Semester	Paper Code	Paper Name	Credits	Marks		Total
					CA	UA	
First Year	I	MAJMAR-101 (Theory)	Marine Botany Major 1	3	35	40	75
		MAJMAR-102 (Practical)	Practical Marine Botany Major -1	1	10	15	25
		MAJMAR - 103 (Theory)	Marine Zoology Major-2	3	35	40	75
		MAJMAR - 104 (Practical)	Practical Marine Major -2	1	10	15	25
		MINMAR – 105 (Theory)	Marine Botany Minor 1	3	35	40	75
		MINMAR – 106 (Practical)	Practical Marine Botany Minor -1	1	10	15	25
		<b>TOTAL</b>				12	90
First Year	II	MAJMAR-201 (Theory)	Marine Zoology Major-1	3	35	40	75
		MAJMAR-202 (Practical)	Practical Marine Zoology Major-1	1	10	15	25
		MAJMAR - 203 (Theory)	Marine Botany Major-2	3	35	40	75
		MAJMAR - 204 (Practical)	Practical Marine Botany Major-2	1	10	15	25
		MINMAR – 205 (Theory)	Marine Zoology Minor-1	3	35	40	75
		MINMAR – 206 (Practical)	Practical Marine Zoology Minor-1	1	10	15	25
		<b>TOTAL</b>				12	90

**DETAILED SYLLABUS OF B.Sc. 1<sup>st</sup> YEAR**  
**SEMESTER - 1**  
**CODE : MAJMAR 101**  
**PAPER NAME : MARINE BOTANY**  
**KSKV Kachchh University, Bhuj - Kachchh**

UNIT	SEM 1 MARINE MAJOR 1 + MINOR	NO. OF LECTURES
1	<p style="text-align: center;"><b><u>INTRODUCTION TO MARINE SCIENCE &amp; CLASSIFICATION</u></b></p> <ul style="list-style-type: none"> <li>▪ Introduction to Marine Science: Definition, Scope &amp; Carrier, Approaches, Relation to other branches of Science.</li> <li>▪ Past, Present &amp; Future Scenarios, Various fields of Marine Science.</li> <li>▪ Classification: Definition, types (Natural, Artificial, and Phylogenetic classification systems), R.H. Whittaker's five kingdom classification system, Eichler's system of Plant classification,</li> <li>▪ Taxonomy: Definition, History, Binomial Nomenclature, Principles of Taxonomy, Hierarchy.</li> </ul>	15
2	<p style="text-align: center;"><b><u>BASICS OF PLANT PHYSIOLOGY</u></b></p> <ul style="list-style-type: none"> <li>▪ Water Potential - biological significance, water relationship of the plants, osmosis, permeability, diffusion, water potential, apoplast and symplast concept, Translocation of solutes.</li> <li>▪ Physiology: Definition</li> <li>▪ Mineral Nutrition: Micro and Macro nutritions, their source and their importance in plant life.</li> <li>▪ Phytohormones: Definition, Brief history, discovery, and Bio essay of Auxins, Gibberlines, Cytokinins, Ethylene, and Abscesic acids.</li> </ul>	15
3	<p style="text-align: center;"><b><u>INTRODUCTION TO MARINE BOTANY - 1</u></b></p> <ul style="list-style-type: none"> <li>▪ Introduction to Marine Botany: Definition, Scope &amp; Carrier, Approaches, Relation to other branches of Science.</li> <li>▪ Sea weeds: Definition, Types, Ecological and Economical Importance of Seaweeds.</li> <li>▪ Seagrass: Definition, General characters with examples, Morphological and Anatomical Adaptations. Ecological Importance of Sea grass.</li> <li>▪ Mangroves: Definition, Types, General Characteristics, Morphological and Anatomical Adaptation of Mangroves.</li> </ul>	15

**LAB./ PRACTICAL PAPER**  
**MARINE SCIENCE**  
**CODE: MAJMAR 102**  
**PAPER NAME : PRACTICAL MARINE BOTANY**

PRACTICAL	AIM OF PRACTICAL
1	To study the RH. Whittaker's Five Kingdom classification through- Photography / Charts / Specimens.
2	To study the following specimens of plants with their classification and General characters with suitable Examples (Any two examples of each) through photographs/charts/specimens.
3	To Demonstrate the process of Osmosis through photo Osmoscope.
4	To Demonstrate the process of Plasmolysis.
5	To Demonstrate the process of Deplasmolysis.
6	To Demonstrate the process of Imbibition.
7	To study the source and importance of micro nutritions (Any five).
8	To study the source and importance of Macro nutritions (any three)
9	To study the Bio-essay of Auxin, Gibberellins, Cytokinin, Ethylene and Abscisic acids.
10	To study the classification and General characters of Chlorophyta, Phaeophyta, and Rhodophyta (Two Examples of each) through Photographs/ Charts/ Specimens.
11	To study the classification and General characters of any three seagrasses through Photographs/ Charts/ Specimens.
12	To study the Morphological Adaptations of Mangroves.
13	To study the Anatomical Adaptation of Mangroves.

**DETAILED SYLLABUS OF B.Sc. 1<sup>st</sup> YEAR**  
**SEMESTER - 1**  
**CODE : MAJMAR 103**  
**PAPER NAME : MARINE CHEMISTRY**  
**KSKV Kachchh University, Bhuj - Kachchh**

UNIT	MAJMAR 103 MARINE CHEMISTRY	NO.OF LECTURES
1	<p style="text-align: center;"><b><u>STRUCTURES OF ATOM AND MOLECULE</u></b></p> <ul style="list-style-type: none"> <li>▪ Basic Chemistry- Atoms and their structure, Lewis dot Structure ,</li> <li>▪ Bohr's Atomic Structure</li> <li>▪ Electronic configuration of elements</li> <li>▪ Classification of Elements on the basis of electron Configuration, Periodic table, and their Properties.</li> <li>▪ Chemical Bonds- Ionic Bonds, Covalent Bonds, Metallic Bonds, Hydrogen Bond, van Der Waals Bond</li> <li>▪ Valance Bond Theory (VBT)</li> <li>▪ Valance Shell electron Pair Repulsion Theory (VSEPR)</li> </ul>	15
2	<p style="text-align: center;"><b><u>OCEAN WATER CHEMISTRY</u></b></p> <ul style="list-style-type: none"> <li>▪ Chemical properties of water and seawater : Reaction of Water with Metals, Non-metals and Metalloids,</li> <li>▪ Elemental composition of seawater, ions, gases, and neutral species,</li> <li>▪ Salts of SASB ,SAWB,WASB,WAWB.</li> <li>▪ constant composition rule – geothermal vents, rivers, and sediments in the control of the composition of seawater.</li> </ul>	15
3	<p style="text-align: center;"><b><u>PHYSICAL &amp; CHEMICAL OCEANOGRAPHY</u></b></p> <ul style="list-style-type: none"> <li>▪ Know our Ocean: Oceans of the world, Sea, Estuary, creeks, inlets, Bay, Gulf, Lagoons, Tide Pool, Hydrothermal vent.</li> <li>▪ Physical properties of seawater – Temperature, Pressure, Density, pH, Conductivity ( Basic Introduction).</li> <li>▪ Properties of Ocean Water Major &amp; Minor Constituents, Salinity, DO, BOD, COD (Basic Introduction)</li> </ul>	15

**LAB./ PRACTICAL PAPER**  
**CODE : MAJMAR 104**  
**PAPER NAME :PRACTICALMARINE CHEMISTRY**

PRACTICAL	AIM OF PRACTICAL
1	Determination of Electronic Configuration: Perform flame tests on different metal salts and identify the characteristic color of the emitted light to determine the electronic configuration of the metal ions.
2	Ionic vs. Covalent Bonds: Demonstrate the difference between ionic and covalent bonds by dissolving table salt (NaCl) in water and sugar (C <sub>12</sub> H <sub>22</sub> O <sub>11</sub> ) in water, observing the conductivity.
3	Investigation of Ocean Water Salinity: Use arefractometer or salinometer to determine the salinity of a given sample of seawater.
4	Ocean Water Density: Measure the density of different water samples with varying salinity using a hydrometer or density meter.
5	Qualitative Analysis of Seawater: Test the presence of various ions in seawater using specific reagents to identify major constituents like chloride, sulfate, magnesium, calcium, etc.
6	Dissolved Oxygen (DO) vs. Biological Oxygen Demand (BOD): Investigate the relationship between DO and BOD in water samples from different sources.
7	Seawater Gas Analysis: Collect gases evolved from seawater samples and identify them using chemical tests (e.g., hydrogen gas test).
8	Preparation of Hydrogen Gas: Generate hydrogen gas in the lab by reacting a metal (e.g., zinc) with hydrochloric acid and collecting the gas over water.
9	Electrolysis of Seawater: Use a Hoffman apparatus to perform the electrolysis of seawater and observe the products of electrolysis.
10	pH and Seawater Buffering: Investigate the buffering capacity of seawater by titrating it with small amounts of acid and base, and measure the change in pH.
11	Study of Water and Metal Reactions: Perform experiments to observe the reaction of water with metals (e.g., sodium, potassium) and classify them into their corresponding reactivity series.

**DETAILED SYLLABUS OF B.Sc. 1<sup>st</sup> YEAR**  
**SEMESTER - 1**  
**CODE : MINMAR 105**  
**PAPER NAME : MARINE BOTANY**  
**KSKV Kachchh University, Bhuj - Kachchh**

UNIT	SEM 1 MARINE MAJOR 1 + MINOR	NO. OF LECTURES
1	<p style="text-align: center;"><b><u>INTRODUCTION TO MARINE SCIENCE &amp; CLASSIFICATION</u></b></p> <ul style="list-style-type: none"> <li>▪ Introduction to Marine Science: Definition, Scope &amp; Carrier, Approaches, Relation to other branches of Science.</li> <li>▪ Past, Present &amp; Future Scenarios, Various fields of Marine Science.</li> <li>▪ Classification: Definition, types (Natural, Artificial, and Phylogenetic classification systems), R.H. Whittaker's five kingdom classification system, Eichler's system of Plant classification,</li> <li>▪ Taxonomy: Definition, History, Binomial Nomenclature, Principles of Taxonomy, Hierarchy.</li> </ul>	15
2	<p style="text-align: center;"><b><u>BASICS OF PLANT PHYSIOLOGY</u></b></p> <ul style="list-style-type: none"> <li>▪ Water Potential - biological significance, water relationship of the plants, osmosis, permeability, diffusion, water potential, apoplast and symplast concept, Translocation of solutes.</li> <li>▪ Physiology: Definition</li> <li>▪ Mineral Nutrition: Micro and Macro nutritions, their source and their importance in plant life.</li> <li>▪ Phytohormones: Definition, Brief history, discovery, and Bio essay of Auxins, Gibberlines, Cytokinins, Ethylene, and Abscesic acids.</li> </ul>	15
3	<p style="text-align: center;"><b><u>INTRODUCTION TO MARINE BOTANY - 1</u></b></p> <ul style="list-style-type: none"> <li>▪ Introduction to Marine Botany: Definition, Scope &amp; Carrier, Approaches, Relation to other branches of Science.</li> <li>▪ Sea weeds: Definition, Types, Ecological and Economical Importance of Seaweeds.</li> <li>▪ Seagrass: Definition, General characters with examples, Morphological and Anatomical Adaptations. Ecological Importance of Sea grass.</li> <li>▪ Mangroves: Definition, Types, General Characteristics, Morphological and Anatomical Adaptation of Mangroves.</li> </ul>	15

**LAB./ PRACTICAL PAPER**  
**MARINE SCIENCE**  
**CODE: MINMAR 106**  
**PAPER NAME : PRACTICAL MARINE BOTANY**

PRACTICAL	AIM OF PRACTICAL
1	To study the RH. Whittaker's Five Kingdom classification through- Photography / Charts / Specimens.
2	To study the following specimens of plants with their classification and General characters with suitable Examples (Any two examples of each) through photographs/charts/specimens.
3	To Demonstrate the process of Osmosis through photo Osmoscope.
4	To Demonstrate the process of Plasmolysis.
5	To Demonstrate the process of Deplasmolysis.
6	To Demonstrate the process of Imbibition.
7	To study the source and importance of micro nutritions (Any five).
8	To study the source and importance of Macro nutritions (any three)
9	To study the Bio-essay of Auxin, Gibberellins, Cytokinin, Ethylene and Abscisic acids.
10	To study the classification and General characters of Chlorophyta, Phaeophyta, and Rhodophyta (Two Examples of each) through Photographs/ Charts/ Specimens.
11	To study the classification and General characters of any three seagrasses through Photographs/ Charts/ Specimens.
12	To study the Morphological Adaptations of Mangroves.
13	To study the Anatomical Adaptation of Mangroves.



**DETAILED SYLLABUS OF B.Sc. 1<sup>st</sup> YEAR****SEMESTER - 2****CODE : MAJMAR 201****PAPER NAME : MARINE ZOOLOGY****KSKV Kachchh University, Bhuj - Kachchh**

UNIT	MAJMAR 201 MARINE ZOOLOGY	NO.OF LECTURES
1	<p style="text-align: center;"><b>CLASSIFICATION AND CELL BIOLOGY</b></p> <ul style="list-style-type: none"><li>▪ General account of animal classification up to phylum.</li><li>▪ Cell: definition, brief history, discovery and cell theory</li><li>▪ Types of cells: typical plant cell and animal cell ; classification of cell on the basis of nucleus: akaryotic cell, prokaryotic cell and eukaryotic cell.</li><li>▪ Cell organelles: general account of plasma membrane, endoplasmic reticulum, mitochondria, chloroplast, nucleus.</li><li>▪ Cell division: definition, cell cycle, mitosis and meiosis.</li><li>▪ Tissue: definition ; types of animal tissue- epithelial tissue, connective tissue, muscular tissue and neural tissue.</li></ul>	15
2	<p style="text-align: center;"><b>PHYSIOLOGY OF ANIMAL-I</b></p> <ul style="list-style-type: none"><li>▪ Digestion and digestive system: definition, comparative study of digestive system in invertebrates (from phylum protozoa to echinodermata) and vertebrates (from class chondrichthys to mammals), general study of digestive enzymes.</li><li>▪ Respiration and respiratory system: definition, comparative study of respiratory system in invertebrates (from phylum protozoa to echinodermata) and vertebrates (from class chondrichthys to mammals), brief account of haemoglobin and haemocyanin, general process of transportation of CO<sub>2</sub> and O<sub>2</sub></li></ul>	15
3	<p style="text-align: center;"><b>PHYSIOLOGY OF ANIMAL-II</b></p> <ul style="list-style-type: none"><li>▪ Circulation and circulatory system: definition, comparative study of circulatory system in invertebrates (from phylum protozoa to echinodermata) and vertebrates (from class chondrichthys to mammals), comparative study of heart: two chambered, three chambered and four chambered</li><li>▪ Excretion and excretory system: definition, comparative study of circulatory system in invertebrates (from phylum protozoa to echinodermata) and vertebrates (from class chondrichthys to mammals), classification of organisms on the basis of excretory materials: ureotelic, ureotelic and ammonotelic ; osmoregulators, osmoconformers, euohaline, stenohaline, hypertonic, hypotonic and isotonic.</li></ul>	15

## LAB./ PRACTICAL PAPER

CODE : MAJMAR 202

PAPER NAME : PRACTICAL MARINE ZOOLOGY 202

PRACTICAL	AIM OF PRACTICAL
1	To study the Classification and General characters of following animals invertebrate (any two Examples of each phylum) Porifera, Coelenterata, Platyhdmintes, Asclehdminthes, Annelida, Arthropoda, Mollusca and Echinodermala.
2	To study the Classification and General characters of following vertebrate animals (any two examples of each class) Pieces, Amphibia, Reptelia, Ares and Mammals.
3	To study the Plants cell and Animal cell.
4	To study the following Cell or ganelles through Photographs/ Charts / Specimens. Plasma membrane, Endoplasmie reticulum, Mitochondria, Chloroplast, Nucleus.
5	To Demonstrate stages of Mitosis in Onion root tip.
6	To study the stages of Meiosis through Photographs / Charts.
7	To study the comparative digestive systems in Colenterada, Annelida and arthropoda through Photographs/ Charts/ Specimens.
8	To study the comparative digestive systems in Fish, Amphibia and aves through Photographs/ Charts/ Specimens.
9	To study the comparative respiration system in Coelenterata, Annelida and arthropoda through Photographs/ Charts/ Specimens.
10	To study the Comparative respiration system in in Fish, Amphibia and aves through Photographs/ Charts/ Specimens.
11	To study pigments of blood- Hemoglobin and harmuscyanin through Photographs/ Charts.
12	To study the Comparative respiration Circulatory system in Coelenterata , Annelida and Arthropada through Photographs/ Charts/ Specimens.
13	To study the Comparative heart- two chambered, three chambered, four

	chambered through Photographs /Charts/ Specimens.
14	To study the Comparative Nervous system in Coelenterata, Annelida and arthropada through Photographs /Charts/ Specimens.
15	To study the Comparative Nervous system in Fish, Amphibia and Ares through Photographs /Charts/ Specimens.

**DETAILED SYLLABUS OF B.Sc. 1<sup>st</sup> YEAR**  
**SEMESTER – 2**  
**CODE : MAJMAR 203**  
**PAPER NAME : MARINE BOTANY**  
**KSKV Kachchh University, Bhuj – Kachchh**

UNIT	MAJMAR 203 MARINE BOTANY	NO.OF LECTURES
1	<p style="text-align: center;"><b><u>INTRODUCTION TO MARINE BOTANY - 2</u></b></p> <ul style="list-style-type: none"> <li>▪ Classification of Algae by Smith: Classification of Algae with their general characteristics and Examples.</li> <li>▪ Distribution of Marine Algae in India and World.</li> <li>▪ Halophytes: Introduction, types and general characters.</li> <li>▪ Plant tissues: Brief account of Simple and Complex Plant tissues.</li> <li>▪ Utilization and economic Importance of Marine Algae: Marine Algae as Food, Fodder, Medicine and industrial raw material.</li> </ul>	15
2	<p style="text-align: center;"><b>PHOTOSYNTHESIS IN MARINE PLANTS</b></p> <ul style="list-style-type: none"> <li>▪ Definition and significance of photosynthesis,</li> <li>▪ Overview of photosynthetic pigments - chlorophylls and their roles.</li> <li>▪ Light Reactions (Light-Dependent Phase) : Structure and function of the photosystems (PS I and PS II)</li> <li>▪ Dark Reactions, Light-Independent Phase : Calvin Cycle, C<sub>3</sub>, C<sub>4</sub>, and CAM pathways</li> <li>▪ Factors Affecting Photosynthesis, Photoperiodicity, Vernalization.</li> <li>▪ Photosynthesis and the Environment: Adaptations of plants to different light conditions.</li> <li>▪ Impact of environmental stressors on photosynthesis – Water Stress, Drought Stress (Introduction)</li> <li>▪ Photosynthesis as a carbon sink and its impact on climate regulation.</li> </ul>	15
3	<p style="text-align: center;"><b>RESPIRATION IN MARINE PLANTS</b></p> <ul style="list-style-type: none"> <li>▪ Definition and significance of respiration, Overview of aerobic and anaerobic respiration.</li> <li>▪ Glycolysis, Krebs Cycle, Electron Transport Chain (ETC) and Oxidative Phosphorylation.</li> <li>▪ Fermentation and Anaerobic Respiration, Respiratory quotient.</li> <li>▪ Environmental Factors Affecting Respiration - Impact of temperature, oxygen availability, and pollutants on cellular respiration.</li> <li>▪ Respiration and global climate change.</li> </ul>	15

**LAB./ PRACTICAL PAPER**  
**MAJMAR 204**  
**PAPER NAME : PRACTICAL MARINE BOTANY**

PRACTICAL	AIM OF PRACTICAL
1	To study the classification and general characters of Chlorophyta, Pheophyta and Rhodophyta (Two Examples of each divisions) through Photographs /Charts/ Specimens.
2	To study the classification and general characters of Xanthophyte and Cyanophyta (Two of each divisions) through Photographs /Charts/ Specimens.
3	To demonstrate distribution of Algae in India and World through Maps.
4	To study the classification and general characters of any two halophytes through Photographs /Charts/ Specimens.
5	To study the characters and functions of Plant Tissues through Photographs /Charts/ Specimens/ Slides.
6	To study the Economic Importance of Marine algae as Food, Fodder, Medicine and Industrial raw material.
7	To Demonstrate chlorophyll pigments through chromatography.
8	To study Calvin cycle and C <sub>4</sub> cycle through Chart / Photograph.
9	To study the CAM pathway.
10	To study the Importance of Photosynthesis in Carbon sink.
11	To Demonstrate the effects of pollution on photosynthesis.
12	To study the process of glycolysis and Krabs cycle.
13	To study the Process of Electron Transport chain (ETC)
14	To Demonstrate the efforts of pollution on respiration of plants.
15	To Demonstrate process of aerobic respiration.

**DETAILED SYLLABUS OF B.Sc. 1<sup>st</sup> YEAR**

**SEMESTER - 2**

**CODE : MINMAR 205**

**PAPER NAME : MARINE ZOOLOGY**

**KSKV Kachchh University, Bhuj - Kachchh**

UNIT	MAJMAR 201 MARINE ZOOLOGY	NO.OF LECTURES
1	<p style="text-align: center;"><b>CLASSIFICATION AND CELL BIOLOGY</b></p> <ul style="list-style-type: none"><li>▪ General account of animal classification up to phylum.</li><li>▪ Cell: definition, brief history, discovery and cell theory</li><li>▪ Types of cells: typical plant cell and animal cell ; classification of cell on the basis of nucleus: akaryotic cell, prokaryotic cell and eukaryotic cell.</li><li>▪ Cell organelles: general account of plasma membrane, endoplasmic reticulum, mitochondria, chloroplast, nucleus.</li><li>▪ Cell division: definition, cell cycle, mitosis and meiosis.</li><li>▪ Tissue: definition ; types of animal tissue- epithelial tissue, connective tissue, muscular tissue and neural tissue.</li></ul>	<b>15</b>
2	<p style="text-align: center;"><b>PHYSIOLOGY OF ANIMAL-I</b></p> <ul style="list-style-type: none"><li>▪ Digestion and digestive system: definition, comparative study of digestive system in invertebrates (from phylum protozoa to echinodermata) and vertebrates (from class chondrichthys to mammals), general study of digestive enzymes.</li><li>▪ Respiration and respiratory system: definition, comparative study of respiratory system in invertebrates (from phylum protozoa to echinodermata) and vertebrates (from class chondrichthys to mammals), brief account of haemoglobin and haemocyanin, general process of transportation of CO<sub>2</sub> and O<sub>2</sub></li></ul>	<b>15</b>
3	<p style="text-align: center;"><b>PHYSIOLOGY OF ANIMAL-II</b></p> <ul style="list-style-type: none"><li>▪ Circulation and circulatory system: definition, comparative study of circulatory system in invertebrates (from phylum protozoa to echinodermata) and vertebrates (from class chondrichthys to mammals), comparative study of heart: two chambered, three chambered and four chambered</li><li>▪ Excretion and excretory system: definition, comparative study of circulatory system in invertebrates (from phylum protozoa to echinodermata) and vertebrates (from class chondrichthys to mammals), classification of organisms on the basis of excretory materials: ureotelic, ureotelic and ammonotelic ; osmoregulators, osmoconformers, euohaline, stenohaline, hypertonic, hypotonic and isotonic.</li></ul>	<b>15</b>

## LAB./ PRACTICAL PAPER

CODE : MINMAR 206

PAPER NAME : PRACTICAL MARINE ZOOLOGY

PRACTICAL	AIM OF PRACTICAL
1	To study the Classification and General characters of following animals invertebrate (any two Examples of each phylum) Porifera, Coelenterata, Platyhdmintes, Asclehdminthes, Annelida, Arthropoda, Mollusca and Echinodermala.
2	To study the Classification and General characters of following vertebrate animals (any two examples of each class) Pieces, Amphibia, Reptelia, Ares and Mammals.
3	To study the Plants cell and Animal cell.
4	To study the following Cell or ganelles through Photographs/ Charts / Specimens. Plasma membrane, Endoplasmie reticulum, Mitochondria, Chloroplast, Nucleus.
5	To Demonstrate stages of Mitosis in Onion root tip.
6	To study the stages of Meiosis through Photographs / Charts.
7	To study the comparative digestive systems in Colenterada, Annelida and arthropoda through Photographs/ Charts/ Specimens.
8	To study the comparative digestive systems in Fish, Amphibia and aves through Photographs/ Charts/ Specimens.
9	To study the comparative respiration system in Coelenterata, Annelida and arthropoda through Photographs/ Charts/ Specimens.
10	To study the Comparative respiration system in in Fish, Amphibia and aves through Photographs/ Charts/ Specimens.
11	To study pigments of blood- Hemoglobin and harmuscyanin through Photographs/ Charts.
12	To study the Comparative respiration Circulatory system in Coelenterata , Annelida and Arthropada through Photographs/ Charts/ Specimens.
13	To study the Comparative heart- two chambered, three chambered, four

	chambered through Photographs /Charts/ Specimens.
14	To study the Comparative Nervous system in Coelenterata, Annelida and arthropada through Photographs /Charts/ Specimens.
15	To study the Comparative Nervous system in Fish, Amphibia and Ares through Photographs /Charts/ Specimens.



**Government Science College, Mandvi – Kachchh**

**B. Sc. Semester – 1 (2023-24)**

**Multi-Disciplinary Course (MDC)**

**Code : MDCMAR 107**

**PAPER NAME : Marine Biotechnology**

**Unit 1: Introduction to Marine Biotechnology**

Definition and scope of marine biotechnology

Genetics: Definition, Mendel's experiments of hybridization and Laws of Inheritance,

Chromosomal basis of Inheritance, Incomplete dominance, Co-Dominance.

Biotechnology: Definition, DNA- as genetic material, RNA and its types, DNA replication, Transcription, Protein synthesis, Genetic code,

Potential applications of marine organisms in medicine, food, and industrial sectors

**Unit 2: Genetic and Biochemical Properties of Marine Organisms**

Introduction to Marine genomics and proteomics

biomolecules from in marine organisms and its importance

Tools and techniques used in marine biotechnology research

Molecular biology techniques: PCR, DNA sequencing, gene expression.

**Unit 3: Applications and Ethics of Marine Biotechnology**

Bioprospecting and biopiracy: exploration and exploitation of marine genetic resources

Role of Marine Biotechnology in conservation & Environment impact

Gene manipulation to improve strains

Diseases in marine organisms: application of biotechnology in disease diagnosis; prevention and control; Gene probes

Genetically modified marine products - Prospects and Problems.

Case studies highlighting successful marine biotechnology applications and challenges

✓ **PRACTICALS WILL BE BASED ON THE THEORY (MDCMAR 108-PRACTICALS)**

## LAB./ PRACTICAL PAPER

CODE : MDC MAR 208

PAPER NAME : PRACTICAL MARINE BIO TECHNOLOGY

PRACTICAL	AIM OF PRACTICAL
1	To study the structure of nucleic acid using model/chart/specimen.
2	To study the structure of amino acid using model/chart/specimen.
3	To study the structure of DNA using model/chart/specimen.
4	To study the structure of RNA using model/chart/specimen.
5	To study the structure of protein using model/chart/specimen.
6	To study microbes under microscope.
7	To study mono- and dihybridization model/chart/specimen.
8	To study human chromosomes structure model/chart/specimen.
9	To study chromosomal aberration and genetical disorders.
10	To study genetic disorders using pedigree analysis using Photographs/ Charts/ Specimens.

**KRANTIGURU SHYAMJI KRISHNA VERMA KACHCHH UNIVERSITY**

**Theory assessment**

**Pattern for Semester end Examination**

<b>Question</b>	<b>Question Type</b>	<b>Total Marks</b>	<b>Remarks</b>
<b>1 (From Unit – 1)</b>	Descriptive Questions with Internal Option.	<b>10 Marks</b>	<b>Question may be of 10 marks/ 5 + 5 marks</b>
<b>2 (From Unit – 2)</b>	Descriptive Questions with Internal Option.	<b>10 Marks</b>	<b>Question may be of 10 marks/ 5 + 5 marks</b>
<b>3 (From Unit – 3)</b>	Descriptive Questions with Internal Option.	<b>10 Marks</b>	<b>Question may be of 10 marks/ 5 + 5 marks</b>
<b>4 (From Unit – 1, 2, 3, 4)</b>	Short Questions, Fill in the Blanks, MCQ, etc. 12 questions (4 questions x 3 units) will be asked with option (10 out of 12)	<b>10 Marks</b>	<b>Total 12 questions from all units will be ask ; students have to attempt any 10</b>

**Note:**

1. The descriptive questions i.e. Question 1, 2, 3 will be like *Explain, describe, discuss* etc. type which may be of 10 marks or 05 + 05 marks.
2. Examiner can ask two questions of 10 marks, of which one must be attempt or examiner can ask three questions of 05 marks, of which two must be attempt.
3. The fourth question can ask from all three units. Total 12 questions (4 questions x 3 units) will be asked, of which 10 must be attempt. Each question carry 01 mark.

**For Internal / College theory assessment**

**Continuous evolution method will be applied for college assessment. Internal theory examination/ Unit test, Seminar, Assignments, Group discussions etc. will be the key part for the internal/ college assessment. The internal assessment will be of 35 marks.**

**The passing criteria for Internal/ college assessment is 40% i.e. students have to secure 14 marks out of 35 marks.**

**KRANTIGURU SHYAMJI KRISHNA VERMA KACHCHH UNIVERSITY**

**Practical assessment**

**Pattern for Semester end Examination**

For university assessment of practicals, 4 to 5 exercises will be arranged for students according to the prescribed syllabus.

The University Practical assessment is of 10 marks.


The passing criteria for practical assessment is 40% i.e. students have to secure 04 marks out of 10 marks.

**For Internal / College assessment**

For Internal/ college assessment of practicals, 4 to 5 exercises will be arranged for students according to the prescribed syllabus.

The Internal/ college Practical assessment is of 15 marks.

The passing criteria for practical assessment is 40% i.e. students have to secure 06 marks out of 15 marks.

  
(Dr. P.K. Mehta)  
BOS chairman  
Marine Science  
KSKV Kachchh University